CLAIMS

What is claimed is:

1.   A processor-based method for determining difficulty measures for training cases used in developing a solution to a problem, comprising:

1   providing a set of training cases having respectively associated difficulty measures;

2   operating a candidate solution on a particular training case;

3   determining a performance measure of the candidate solution operating on the

4   selected training case;

5   determining a credibility rating of the candidate solution, the credibility rating

6   indicating a proficiency level of the candidate solution at solving training cases; and

7   modifying the difficulty measure of the particular training case based on the

8   performance measure of the candidate solution operating on particular training case and

9   the credibility rating of the candidate solution.

1   2.   The method of claim 1, wherein determining the credibility rating

2   comprises:

3   selecting one or more training cases from the set of training cases based on the

4   difficulty measures of the one or more training cases;

5   determining performance measures of the candidate solution operating on each of

6   the one or more training cases; and

7   computing the credibility rating based on the performance measures of the

8   candidate solution operating on each of the one or more training cases.

1   3.   The method of claim 2, wherein the one or more training cases does not

2   include the particular training case.

1   4.   The method of claim 1, wherein providing the set of training cases having

.2 respectively associated difficulty measures comprises initializing a difficulty measure of

3   each training case in the set of training cases to a predetermined value.

1   5.   The method of claim 4, wherein the predetermined value is a maximum

2   value.

1   6.   The method of claim 1, wherein:

2   providing the set of training cases comprises associating each training case in the

3   set of training cases with a target output;

4   operating the candidate solution on the particular training case comprises obtaining

5   an output from the candidate solution operating on the particular training case; and

6   determining the performance measure of the candidate solution operating on the

7   particular training cases comprises comparing the candidate solution output to a target

8   output of the particular training case.

1   7.   : The method of claim 6, wherein comparing the candidate solution output to

2   the target output of the particular training case comprises calculating a value

3   corresponding to a deviation between the candidate solution output and the target output of

4   the particular training case.

1   8.   The method of claim 1, wherein modifying the difficulty measure of the

2   particular training case comprises modifying the difficulty measure based on a weighted

3   average of the performance measure and a previous value of the difficulty measure.

1   9.   The method of claim 8, wherein a weight of the weighted average is based

2   on the credibility rating and a base learning rate.

1   10.   The method of claim 1, wherein modifying the difficulty measure

2   comprises maintaining the difficulty measure within a predetermined interval.

1   11.   A processor-based method for solving a problem, comprising:

2   providing a set of candidate solutions;

3   providing a set of training cases having respectively associated difficulty measures;

4   operating a candidate solution on a particular training case;

5   determining a performance measure of the candidate solution operating on the

6   particular training case;

7   determining a credibility rating of the candidate solution, the credibility rating

8   indicating a proficiency level of the candidate solution at solving training cases;

9   modifying the difficulty measure of the particular training case based on the

10   performance measure of the candidate solution and the credibility rating of the candidate

11   solution;

12   evaluating the candidate solution; and

13   modifying the set of candidate solutions based on the evaluation.

1   12.   The method of claim 11, wherein:

2   providing the set of training cases comprises respectively associating the training

3   cases in the set of training cases with target outputs;

4   operating the candidate solution on the particular training case comprises obtaining

5   an output from the candidate solution operating in the context of the particular training

6   case; and

7   determining the performance measure of the candidate solution operating on the

8   particular training case comprises comparing the candidate solution output to a target

9   output of the particular training case.

1   13.   The method of claim 11, wherein evaluating the candidate solution

2   comprises:

3   selecting one or more training cases based on the difficulty measures of the one or

4   more training cases; and

5   operating the candidate solution on each of the one or more selected training cases.

1   14.   The method of claim 13, wherein selecting the one or more training cases

2   comprises biasing selection of the one or more training cases towards more difficult

3   training cases in the set of training cases.

1   15.   The method of claim 13, wherein selecting each of the one or more training

2   cases comprises:

3   randomly selecting a subset of training cases from the set of training cases; and

4   selecting a training case from the subset of training cases based on the difficulty

5   measure of the selected training case.

1   16.   The method of claim 15, wherein selecting the training case comprises

2   selecting the training case having a relatively high difficulty measure in comparison with

3   other training cases in the subset of training cases.

1   17.   The method of claim 13, wherein selecting each of the one or more training

2   cases comprises:

3   selecting a subset of training cases from the set of training cases based on the

4   difficulty measures of members of the subset; and

5   selecting a training case from the subset.

1   18.   The method of claim 13, wherein selecting each of the one or more training

2   cases comprises selecting a training case based on a probability computed as a function of

3   a difficulty measure of the selected training case and the difficulty measures of members

4   of the set of training cases.

1   19.   The method of claim 11, wherein determining the performance measure of

2   the candidate solution comprises calculating a value corresponding to a deviation between

3   an output of the candidate solution and the target output.

1   20.   The method of claim 11, wherein modifying the set of candidate solutions

2   comprises modifying one or more particular candidate solutions in the set of candidate

3   solutions.

1   21.   The method of claim 11, wherein modifying the set of candidate solutions

2   comprises forming a new set of candidate solutions.

1   22.   A system, comprising:

2   an input unit configured to provide a set of training cases and a set of candidate

3   solutions, each training case having an associated difficulty measure; and

4   a processor configured to determine a credibility rating of a candidate solution and

5   a performance measure of the candidate solution operating on a particular training case,

6   the processor further configured to modify a difficulty measure of the particular training

7 . case based on the performance measure and the credibility rating,

8   wherein the credibility rating indicates a proficiency of the candidate solution at

9   solving training cases.

1   23.   The system of claim 22, wherein the processor is configured to select one

2   or more training cases from the set of training cases based on difficulty measures of the

3   one or more selected training cases, determine performance measures of the candidate

4   solution operating on each of the one or more selected training cases, and compute the

5   credibility rating based on the performance measures of the candidate solution operating

6   on each of the one or more training cases.

1   24.   The system of claim 22, wherein the processor is configured to obtain an

2   output from the candidate solution operating on the particular training case, compare the

3   candidate solution output and a target output of the particular training case, and determine

4   the performance measure of the candidate solution based on the comparison.

1   25.   The system of claim 22, wherein the processor is configured to modify the

2   difficulty measure of the particular training case based on a weighted average of the

3   performance measure and a previous value of the difficulty measure.

1   26.   The system of claim 22, wherein the processor is further configured to

2   evaluate the candidate solution and modify the set of candidate solutions based on the

3   evaluation.

1   27.   The system of claim 26, wherein the processor is configured to select one

2   or more training cases based on the difficulty measures of the one or more training cases,

3   operate the candidate solution on the one or more training cases, determine a performance

4   measures of the candidate solution operating on the one or more selected training cases,

5   and evaluate the candidate solution based on the performance measures.

1   28.   The system of claim 27, wherein the processor is configured to bias
2   selection of the one or more training cases towards training cases that are more difficult to
3   solve than other training cases in the set of training cases.

1   29.   A system for determining training case difficulty measures, comprising:
2   means for providing a set of training cases having respectively associated difficulty
3   measures;
4   means for operating a candidate solution on a particular training case;
5   means for determining a performance measure of the candidate solution operating
6   on the selected training case;
7   means for determining a credibility rating of the candidate solution, the credibility
8   rating indicating a proficiency of the candidate solution at solving training cases; and
9   means for modifying the difficulty measure of the particular training case based on
10   the performance measure of the candidate solution operating on particular training case
11   and the credibility rating of the candidate solution.

1   30.   An article of manufacture for determining a solution to a problem,
2   comprising:
3   a computer-readable medium configured with instructions for causing a computer
4   to perform the method of,
5   providing a set of candidate solutions;
6   providing a set of training cases having respectively associated difficulty measures;
7   operating a candidate solution on a particular training case;
8   determining a performance measure of the candidate solution operating on the
9   particular training case;
10   determining a credibility rating of the candidate solution, the credibility rating
11   indicating a proficiency of the candidate solution at solving training cases;
12   modifying the difficulty measure of the particular training case based on the
13   performance measure of the candidate solution and the credibility rating of the candidate
14   solution;
15   evaluating the candidate solution; and
16   modifying the set of candidate solutions based on the evaluation.